
Developing Math/Science Teacher Leadership: A Consensus Approach to Evaluating Program Quality and Supporting Teacher Leader Workforce Development

BSCS Technical Report No. 2017-04

Symposium Proceedings

A Report of
*The Developing Math/Science Teacher Leadership: A Consensus
Approach to Evaluating Program Quality and Supporting
Teacher Leader Workforce Development Project*

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BSCS

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Developing Math/Science Teacher Leadership: A Consensus Approach to Evaluating Program Quality and Supporting Teacher Leader Workforce Development

BSCS Technical Report 2017-04

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A report of the Developing Math/Science Teacher Leadership: A Consensus Approach to Evaluating Program Quality and Supporting Teacher Leader Workforce Development Project, a collaboration of BSCS, the Knowles Teacher Initiative, and the Education Development Center

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Recommended citation:

Bintz, J., Mohan, L., Miller, B., Mohan, A., Galosy, J., & Stuhlsatz, M. (2017). *Developing math/science teacher leadership: Symposium Proceedings* (Research Report No. 2017-04). Colorado Springs, CO: BSCS.

This work was supported by a grant from the National Science Foundation (grant number 1534698). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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1. Project Summary

Developing Math/Science Teacher Leadership: A Consensus Approach to Evaluating Program Quality and Supporting Teacher Leader Workforce Development was proposed in the National Science Foundation Education and Human Resources Core Research (ECR) STEM Teacher Workforce focal area to synthesize theory, research, and practice in math/science teacher leadership development. The purpose of this synthesis project is to build consensus on the key attributes of high quality math/science teacher leadership development programs. High quality teacher leadership programs are those that prepare and support teachers to positively impact math/science teaching and learning beyond their own classrooms. The three major objectives of the project are to (1) review research on math/science teacher leadership development and descriptions of existing programs; (2) bring together a group of knowledgeable practitioners, researchers, and policy makers to build consensus on key attributes of quality programs; and (3) communicate to stakeholders the consensus attributes along with recommendations for implementation and future work. Key attributes are characteristics or features of programs identified through a consensus process as most essential for effective math/science teacher leadership development. The attributes will address program content, pedagogy, and structure, for example, specific structures and strategies that support and sustain teachers in learning the knowledge and skills they need for leadership.

We pursued three research questions in this project:

- What patterns exist among attributes of math/science teacher leadership development programs?
- What patterns exist in how teacher leadership development programs define and measure program quality?
- What evidence exists for the effectiveness of teacher leadership development programs?

This project unfolded in four basic phases:

Phase I Literature review (i.e., summary of reviews of research literature and teacher leadership development programs). The purpose for this phase is to describe the current landscape of teacher leadership and teacher leadership development. Reports will be posted on the project website for review prior to the symposium. The products of this phase will provide “grist for the mill” during the symposium to help us answer our research questions.

Phase II Symposium. During the symposium, participants will study the initial reviews of the research literature and programs for patterns in responses and collaboratively develop responses to focus questions.

Phase III Consensus-building review. The purpose of the consensus-building review process is to achieve consensus among the members of the advisory and symposium teams about the responses to the research questions and synthesis report. All phases of the work so far will build toward this process and the development of the synthesis report in the final part of the project.

Phase IV Synthesis writing and communication. The leadership team will develop the final synthesis report and disseminate according to our communication strategy.

The proceedings of the symposium described in this document provide background, describe activities, and report findings.

2. Leadership Team

The project leadership team includes representatives from BSCS, the Knowles Science Teaching Foundation (KSTF), and the Education Development Center (EDC). Project evaluation services are provided by Horizon Research, Inc.

Jody Bintz, M.A., is Co-Director of Professional Learning at BSCS and served as PI for this project. Bintz has over 10 years of experience in science leadership development and over 20 years of experience in teacher professional development and providing technical assistance supporting district-wide improvement efforts. She directed the BSCS National Academy for Curriculum Leadership (NACL) for secondary science leadership teams through a six-year scale-up in the state of Washington involving over 30 districts. This scale-up effort followed the national research and development process supported by the National Science Foundation. Bintz is currently PI of a project to study of the impact on student achievement of the NACL in Washington State. Bintz is currently directing a project to develop and broadly disseminate tools and processes for district leaders to analyze instructional materials and plan for instruction and classroom assessment in light of the Next Generation Science Standards. This work is supported by the Carnegie Corporation of New York.

Barbara Miller, Ed.D., is Division Director in the Learning and Teaching Division at Education Development Center (EDC) and serves as Co-PI of this project. Miller has over 25 years of experience in professional development and technical assistance for school district and program staff, research on professional development and teacher leadership in mathematics and science, and evaluation of systemic reform efforts. Miller directed the award-winning *Success at the Core* project, a video-based professional development toolkit designed to improve instructional quality in classrooms and among school leadership teams. She has conducted research on knowledge management for the National Science Foundation's Math and Science Partnership program by synthesizing and sharing knowledge from the field around teacher leadership and professional learning communities.

Jodie Galosy, Ph.D., is the Director of Research and Evaluation at the Knowles Science Teaching Foundation (KSTF) and serves as Co-PI of this project. Galosy oversees the study of the KSTF Fellows program on math and science teaching and teacher leadership. Galosy's areas of expertise include research and practice in science teaching, teacher professional development, teacher induction, and teacher leadership development.

Lindsey Mohan, Ph.D., is a Research Scientist at BSCS. Her work focuses on the design of innovative instructional resources and effective teaching practice, particularly in science and geography education. Mohan has conducted research on learning, teaching, and instructional material design in the areas of science learning progressions, environmental literacy, and problem-based learning.

Joan D. Pasley, Ph.D., is Vice President at Horizon Research, Inc. and serves as the external evaluator for this project. Pasley has been working with HRI since 1994 on numerous technical assistance, research, and evaluation projects. She directed the program evaluations of the Merck Institute for Science Education's Consortium for Achievement in Mathematics and Science, which prepared teams of science teacher leaders, and the National Science Teacher Association's New Science Teacher Academy and the E-Mentoring for Student Success project, which trained experienced teachers to do content-based mentoring with new science and mathematics teachers. She served as PI for the Math and Science Partnership Knowledge Management and Dissemination project and deputy director of the science strand for US Department of Education-funded Center on Instruction. Currently, Pasley directs HRI's evaluations of several NSF-funded projects, including the University of Florida's FUTuRES project, which is preparing science teacher leaders to support science education reform in their school districts.

3. About the Symposium

Purpose and Approach

The symposium was intended to serve as a “live synthesis” of the research and program summaries. To serve this purpose, the symposium was designed to include small- and whole-group work focused on the research and program literature reviews, iterative processes leveraging the expertise of symposium participants, and feedback mechanisms to test ideas under consideration. To ensure that the symposium team comprised leaders in math/science teacher leadership development, the symposium team members were selected based on key criteria including the following:

- Organizational Role
 - District or school leader
 - Institute of higher education
 - Informal educator
 - Nonprofit
 - Policy maker
- Expertise
 - Math and/or science
 - Teacher leader practitioner
 - Designer or provider of leadership development program
 - Leadership development program researcher
 - Multiple programs

To help frame the symposium and the development of the agenda, symposium team members received the program and research literature summaries prior to the symposium and were polled based on the focus questions below. Their responses were analyzed by the leadership team. These results were printed for symposium participants and included in their symposium materials. Through this process, we noted that many ideas spanned both the research and program summaries as well as the conversations among participants. Key patterns in responses to each question are listed after each question. These patterns in responses informed the design of the symposium.

FQ 1: What do you see as the strengths and limitations of the research literature focused on math/science teacher leadership? What is missing in the research literature review?

- Few studies met study criteria, and substance could be added by looking outside math and science.
- Greater clarity is needed for the definitions of teacher leader, teacher leadership, teacher leader development, and teacher leadership development.

FQ 2: What do you see as the strengths and limitations of math/science teacher leadership development programs? What is missing in the summary of the review of programs?

- More information about program design and attributes is needed, but programs tend to focus on both quality teaching and leadership development.
- Lukacs and Galluzzo’s (2014) models were helpful as a framework to organize programs.
- A focus on “systems” is limited, and more work should be done to examine issues of teacher leadership at the systems level.

FQ 3: How well is the system supporting the development of the different kinds of math/science teacher leadership? What seems typical, atypical, or missing? To what extent does, or should, teaching experience influence the ways in which teacher leadership is developed?

- Support is neither systemic nor thorough and therefore not sustainable.
- Teacher experience in programs is highly variable, and therefore attention to the needs of teachers along a professional continuum may be limited.

FQ 4: The math/science teacher leadership development programs included in the reviews vary in terms of number of participants and duration. Some have few participants who work intensively together over a period of years, some never end, and others last one to two years and then end. What opportunities and challenges does teacher leadership development as an extended, ongoing process offer compared with shorter, less-intensive teacher leadership development approaches?

- Duration is critical to developing community and overall success.
- Increased program duration may limit participation by teachers (and potentially districts) and increases cost per teacher leader.

Goals and Products

The intended outcomes were communicated to symposium participants prior to event.

Symposium Meeting Goals: The specific goals of the teacher leadership symposium meeting are to promote collaboration and build consensus among science and math education leaders regarding

1. an understanding of the project,
2. findings synthesis of research on math and science teacher leadership development,
3. patterns in attributes of math and science teacher leadership development programs, and
4. recommendations for future research and development and STEM teacher workforce pathways.

Products from the Symposium: The products from this work include

- symposium proceedings draft and
- elaborated outline of the synthesis report.

Participants

The symposium was held at the Cheyenne Mountain Resort in Colorado Springs, CO, from Friday evening, April 29, through Tuesday morning, May 3, 2016, and involved 20 participants including the project team, symposium team, advisors, and a facilitator.

Symposium Team

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Jill Harrison Berg

University of Massachusetts, Boston

Patricia F. Campbell

University of Maryland

Cathy Carroll

WestEd STEM Program

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Barbara Miller

Vice President and Director of Learning and Teaching Division, EDC
Co-Principal Investigator

Lindsey Mohan

Research Scientist, BSCS

Joan Pasley

Vice President, Horizon Research, Inc.

4. Approach to Summarizing Findings from the Symposium

During the symposium, project staff captured notes during small-group work and whole-group discussions. Periodically, small groups provided written feedback on work products from other groups, and the leadership team tested patterns in findings developed during the symposium by sharing these findings with the whole group and gathering feedback. These efforts represented a “live synthesis”.

Project staff analyzed symposium documents and project staff notes for patterns, and the patterns were summarized. The summaries are included below and are organized by the prompt that guided symposium participant work.

5. Symposium Findings

What important ideas in the research literature review, program review, and participant responses require attention by the whole group? What’s in and out? Why? (Saturday morning session)

Participants began the symposium with a broad view of math/science teacher leadership and teacher leadership development, including the importance of teacher leaders, the roles and responsibilities of formal and informal teacher leaders, their effectiveness, and ways in which their development and work is supported (or not) by schools, districts, and others. The symposium participants also wondered aloud about foundational principles from core values, rationale for math/science teacher leadership, importance or impact of their work, and definitions of math/science teacher leadership. Related specifically to the purpose for the project and the symposium, they wondered about the decisions of the leadership team in the selection of research literature and programs to include in the study. They also wondered about the purpose of and audience for the final synthesis report. One group raised a question about differences in the needs, development, and impact of math/science teacher leaders at the elementary and secondary levels.

To help frame the work of the symposium, the leadership team offered some ideas. Generally, the focus of the synthesis project and the symposium is on math/science teacher leadership development programs and not STEM teacher leadership nor general teacher leadership, the effectiveness of teacher leaders, and the development of growth of teacher leaders outside of formal programs. The leadership team also emphasized the importance of using a conceptual framework, like that provided by Lukacs and Galluzzo (2014), to help organize the summaries and final synthesis report. We also recognized that the field is not guided by lines of research, as evidenced by the findings from the summary of the research literature review, but that the synthesis report will be forward thinking.



Symposium Findings from the Research Summary

(Saturday afternoon and Sunday morning session)

Following are guiding questions for this session:

1. *What are the key findings in the research on math/science teacher leadership development (i.e., what do we know)?*
2. *What are the critical gaps in the research (i.e., what do we need to know)?*
3. *What specific research would fill the gaps, and what are the priorities?*

What are the key findings in the research on math/science teacher leadership development (i.e., what do we know)?

The research included in this synthesis study represents a small part of the landscape of teacher leaders, teacher leadership, teacher leadership development, and teacher leadership development programs. This study is focused on research targeting teacher leadership development programs. As described in the summary report, most studies are qualitative and descriptive, rather than quantitative, with small sample sizes. Few (if any) of the research studies included in this synthesis gathered impact data (beyond self-report)—student learning, teacher learning, teacher practice, and leader practice (see summary report for details). The teacher leadership development programs focus on a range of content for the leadership development curriculum and employ a variety of strategies (see summary report for details). The predominant strategy is the workshop or institute model including self-reflection and metacognition. Some programs employ a cohort model and embed follow-up strategies such as coaching and extend over multiple years. Generally, the programs are grounded in the research and literature describing effective professional development (see summary report for details). The content of the leadership development curriculum tends to place a heavy emphasis on effective teaching. This trend may be in service of the purpose for many of the programs—developing teacher leaders as professional development (PD) providers for a specified program. This trend may result in teacher leaders with a limited view of teacher leadership as focused on leading PD rather than a broader view of teacher leadership as change agents.

The summary report also highlights problems that plague teacher leadership development programs, such as the need to (1) sustain development over time, (2) be context-specific, (3) be grounded in practice, and (4) employ active, collective learning. These patterns are important given the intention to apply a “systems lens” to the findings in this synthesis study. Symposium participants also highlighted the minimal number of research studies included in the summary report and noted that our ability to draw conclusions about “what we know” is limited.



What are the critical gaps in the research?

The lack of impact studies in the teacher leadership development program genre represents a significant gap. Moreover, there is a gap in the research literature of studies linking program goals and/or outcomes with results that employ common and appropriate measurement tools and methods. These connections need to include comparisons of strategies and a determination of conditions under which strategies or approaches are more or less effective—again, highlighting the need for common measures and methods. These gaps are particularly evident in math/science teacher leadership, making it difficult to assess the return on investment for taking a particular leadership development program to scale. One factor that could contribute to larger scale studies of teacher leadership development programs is a common framework of teacher leadership development and theories of math/science leader learning. The only other frameworks captured at the symposium were related to standards for “general” teacher leadership, including the Standards for Professional Learning released by NSDC/Learning Forward (2011) and the Teacher Leader Model Standards (Teacher Leadership Exploratory Consortium, 2011).

Currently, the field has no forum for considering evaluation reports nor for evaluation reports to be peer reviewed so that these reports can contribute to the knowledge base.



What specific research would fill the gaps, and what are the priorities? (Sunday morning session)

Math/science teacher leadership development programs need to attend to the professional continuum of teacher leaders, and the research on such programs could study the progression of the knowledge, skills, and dispositions over time linked to influence on student learning and other important outcomes, including teacher retention. Ultimately, studies of teacher leadership development should leverage collective teacher leadership that (1) sustains systems of high quality instruction to support student learning; (2) promotes teacher growth and retention; (3) drives continuous school improvement; (4) advises district (local) and state decision-making; and (5) contributes to local, regional, and national math/science teacher workforce development. Studies could extend the consideration of teacher workforce development to follow teacher leaders who leave the classroom to serve in other education leadership roles (e.g., district administration, higher education, education policy). To achieve many of these broad outcomes, more teacher leadership development programs should focus on Lukacs and Galluzzo's (2014) Model Three.

While the programs considered in this synthesis study attended to the features of high quality/ effective professional development, symposium participants recommended studies of effective teacher leadership development including ongoing support built into programs and the supports provided (or not) at the teacher leaders' local sites. Research should go beyond the development and study of "great teaching" and consider the knowledge, skills, and disposition of "great teacher leaders".

Symposium participants noted an important gap in connections to the systems in which teacher leaders work. They advocated that designers and researchers consider the extent to which programs are connected to the broader improvement strategy and institutional systems and structures within the school/district.

Symposium participants strongly advocated that programs be designed with an equity lens to strengthen the overall system of teacher leadership development for districts, schools, teachers, and students. One result of this effort would be greater system capacity to identify, support, and address the needs of students with diverse learning needs. While this synthesis study is not attending to ad hoc development of teacher leadership, many of our symposium participants deeply value these approaches. They highlighted the lack of research focused on such development and cited such research as a potential source of ideas for how to improve teacher leadership development programs.

Research on math/science teacher leadership development programs should be designed as impact studies and link goals and outcomes with appropriate measures and methodologies to provide evidence of effectiveness. Such studies would help to identify and address issues of scale. A framework for teacher leadership development and a theory of math/science leader learning could help researchers and program designers with scale-focused designs.

The symposium team advocated that such lines of research and the programs studied will contribute to increasing the overall quality of programs with sufficient and appropriate evidence to justify taking the most promising programs to scale. The overall goal cited by the symposium team was to develop a more coherent system of support for teacher leaders who are at work in both formal and informal roles in schools throughout the country.



Symposium Findings from the Program Summary

(Sunday afternoon session)

Following are guiding questions for this session:

1. *What ideas, outcomes, or lessons learned do you want to elevate, highlight, or question from the program review? What do we really need to pay attention to?*
2. *What else do we need to know and why?*
3. *What is needed beyond the program review summary?*

What ideas, outcomes, or lessons learned do you want to elevate, highlight, or question from the program review? What do we really need to pay attention to?
(Conversation was revisited on Sunday afternoon.)

Topics highlighted in this discussion included

- the common elements identified in effective teacher professional development and used in the design of teacher leader development programs;
- the focus in terms of time and effort of many programs on developing great teachers vs. great leaders and the resulting focus on discipline-specific content;
- the potential need for greater focus on leadership-related content (e.g., understanding change, leading adult learning, advocacy, managing conflict);
- the lack of clearly articulated and justified selection criteria;
- issues of sustainability given the current status of funding (e.g., funding cycles, lack of planning for sustainability, lack of evidence to suggest promising programs that are worthy of taking to scale); and
- ensuring coherence throughout the system in terms of models and frameworks to support learning, support for enactment, and work with administrators.



What else do we need to know and why?

Symposium participants reiterated the need for alignment among program goals and outcomes, audience needs, program design elements guided by consensus models and frameworks, research questions, measures, and methodologies. The overall goal of achieving this kind of alignment is the ability to interpret evidence in ways that can lead to an assessment of return on investment and guide decision makers.



What is needed beyond the program review summary?

Symposium participants expressed interest in knowing more about the audiences for teacher leadership development programs, noting that programs seem to include both early career and experienced teachers but wondering if and how building-level or district administrators participated in such programs. Participants also wished for more information about program structure, particularly duration given the results of research on effective PD and impact on student learning or culture, and strategies used to develop teacher leaders. They posed questions about the value of looking outside the strategies and activities used in effective PD for ideas about developing leaders.

The publicly available program descriptions and therefore the program summary did not include the kinds of information that symposium participants hoped to find. Symposium participants recommended the leadership team go back to the literature to gather additional information in these categories:

- Provide summary of the conceptual frame and competencies/standards documents, including Teacher Leader Model Standards and the Teacher Leadership Initiative
- Expand search to include literature on coaching, mentoring, department chairs, instructional resource teachers, and other teacher leader roles
- Determine in what ways teacher leadership development programs are tied into human capital and/or school improvement (linked to the system)



Symposium Recommendations

Rationale and Making the Case: Argument for the Importance of Teacher Leadership Development

What can we recommend for future research and program design and development?

Mathematics and science teacher leaders emerge all over the country every day. Somehow, they are developed for this role—likely, in ad hoc and disjointed fashions, rarely in formal programs, but developed none-the-less. We don't know much about the programs that do this with at least some intentionality, and we certainly don't know much about the myriad of ad hoc ways that teacher leaders assume this role—informally or as a formal leader.

We believe teacher leaders are a critical component of an improvement infrastructure and advocate that it would be better if we considered the coherence, continuum, and components of programs and research agendas. This purposeful approach has the potential “to get more bang for the buck” than the current disjointed approach.

A persuasive argument might be made following this sequence:

- Our system of teacher preparation doesn’t work very well.
- It’s hard and rare to find districts using PD that helps vast numbers of teacher meaningfully get better.
- We are generally not very good at differentiating teachers, even those who teach the same grades and subjects.
- Teacher leaders are an infrastructure—maybe flat and weak (critique of the system, not of the teacher leaders)—but there is not an effective infrastructure supporting their work, and we need to leverage the existing “what works” to build an improved infrastructure.



Symposium Findings: Audience for Report

Who is the audience for a report on teacher leadership development?

The final synthesis report should address a broad audience and offer specific findings and recommendations relevant to the following audiences:

- Program consumers/implementers
- Program designers/developers
- Researchers
- Policy makers
- Funders

Also see the summary of recommendations for closing the research gap.



6. Symposium Evaluation

We surveyed the symposium participants to evaluate the symposium. We posed nine total questions, including eight Likert scale–style questions, each with an opportunity to add comments, and a final open-ended prompt for additional comments. Results from this survey informed the concluding remarks in the final section.

1. The goals of the *project* were clearly communicated prior to the symposium.
2. The goals of the *symposium* were clearly communicated during the symposium.
3. The symposium was well organized to draw on the knowledge and expertise of the symposium team members.
4. My ideas and contributions during the symposium were thoughtfully considered by the leadership team.
5. My ideas and contributions during the symposium were thoughtfully considered by other symposium team members.
6. The *research review* was a useful source document for discussing what is known about mathematics/science teacher leadership development programs and identifying gaps in this knowledge base.
7. The *program review* was a useful source document for discussing what is known about mathematics/science teacher leadership development programs and identifying what we still need to know.
8. To what extent do you think the goals of the symposium were met?
 - 1) Develop a shared understanding of the project.
 - 2) Continue the synthesis of research on math/science teacher leadership development.
 - 3) Begin to build consensus on *patterns* in the attributes of math/science teacher leadership development programs, how those programs define and measure quality, and their evidence of effectiveness.
 - 4) Begin to develop recommendations for future research and development and STEM teacher workforce pathways.
9. Please provide any additional comments you have about the symposium.

7. Concluding Remarks Based on the Symposium Evaluation

Generally, symposium team members reported that the goals of the symposium were clearly communicated before and during the symposium. The primary questions from team members were focused on the deliverables and relationships among them. For example, one participant thought that the draft summaries provided prior to the symposium represented a draft of the synthesis report. What became clear in some participant responses and during the symposium was that some team members approached teacher leadership and development from a broad perspective and found this synthesis study too limiting. While the majority of symposium team members indicated that we accomplished each of the goals, the variation in responses was greatest for goals 2 and 3. Symposium team members reported that the symposium was well organized and generally well facilitated in whole-group and small-group work to allow for the sharing of expertise, experience, and ideas. Symposium team members shared appreciation for the summary documents but expressed concerns about the limitations of the reports. One respondent captured the overall gist of the responses by saying, “There just ain’t much there.” Other respondents considered the criteria for inclusion in the study quite limiting and therefore decreased the value of time spent on the research reviews during the symposium.

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